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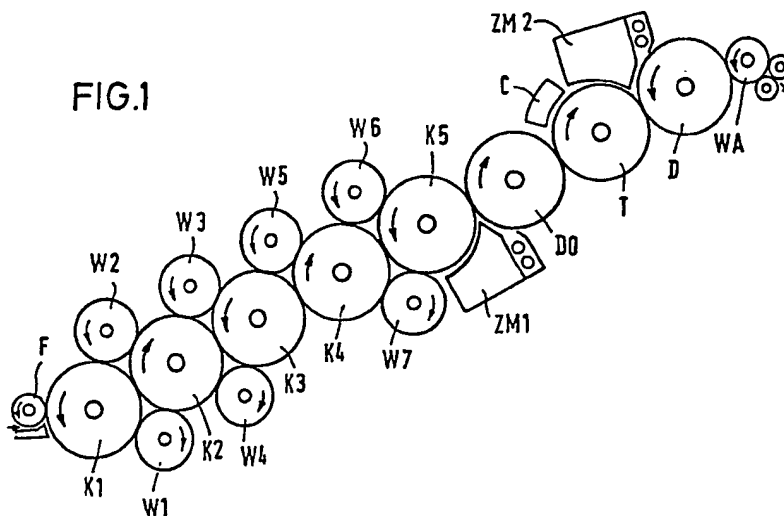
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D1N

## (54) Producing fibrous web

(57) There is disclosed a method and apparatus for producing a random fibrous web from spinning material, such as wool, cotton and man-made fibres. There is a carding zone in which fibrous flocks are disentangled and spread out into a fibrous web and a doffing device operates continuously to remove the web from the carding zone. After the carding zone, the fibrous web is subjected to an accumulator effect and subsequently to free web formation along a short section of predetermined length (centrifugal former (ZM2)). In this connection, the fibrous web is subjected, before and/or in the zone of the centrifugal dynamic web forming means (ZM2) at the cylinder (T) with the centrifugal former ZM2, to an additional carding action by means of a carding segment (C) which is arranged immediately before the centrifugal former (ZM2) associated with the cylinder (T) at the latter. An additional web formation zone using a former ZM1 may be provided.



GB 2 151 667 A

FIG.1

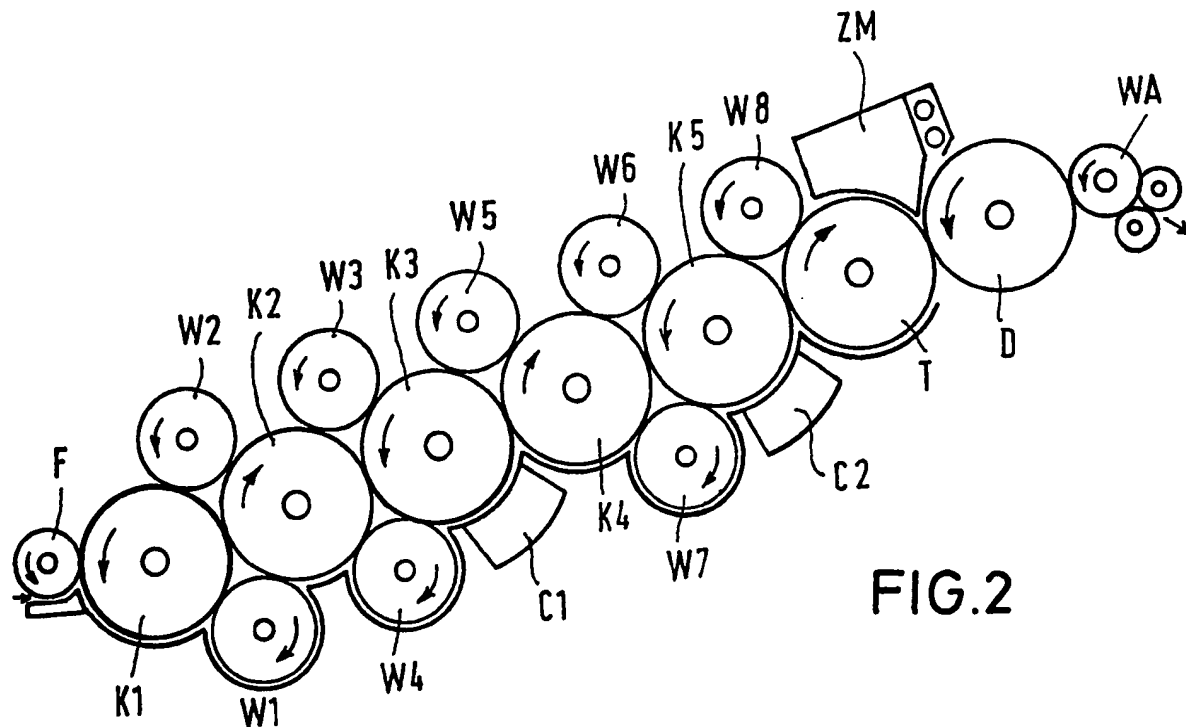
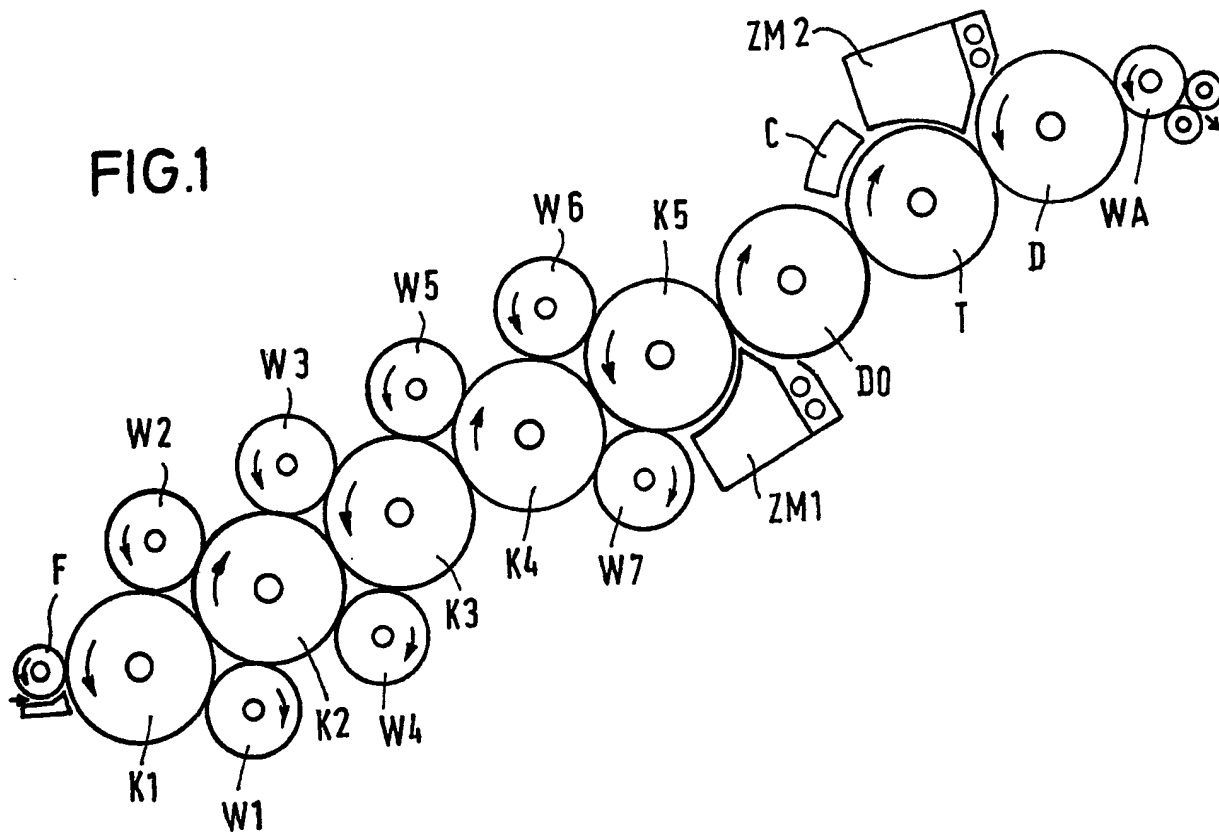


FIG.2

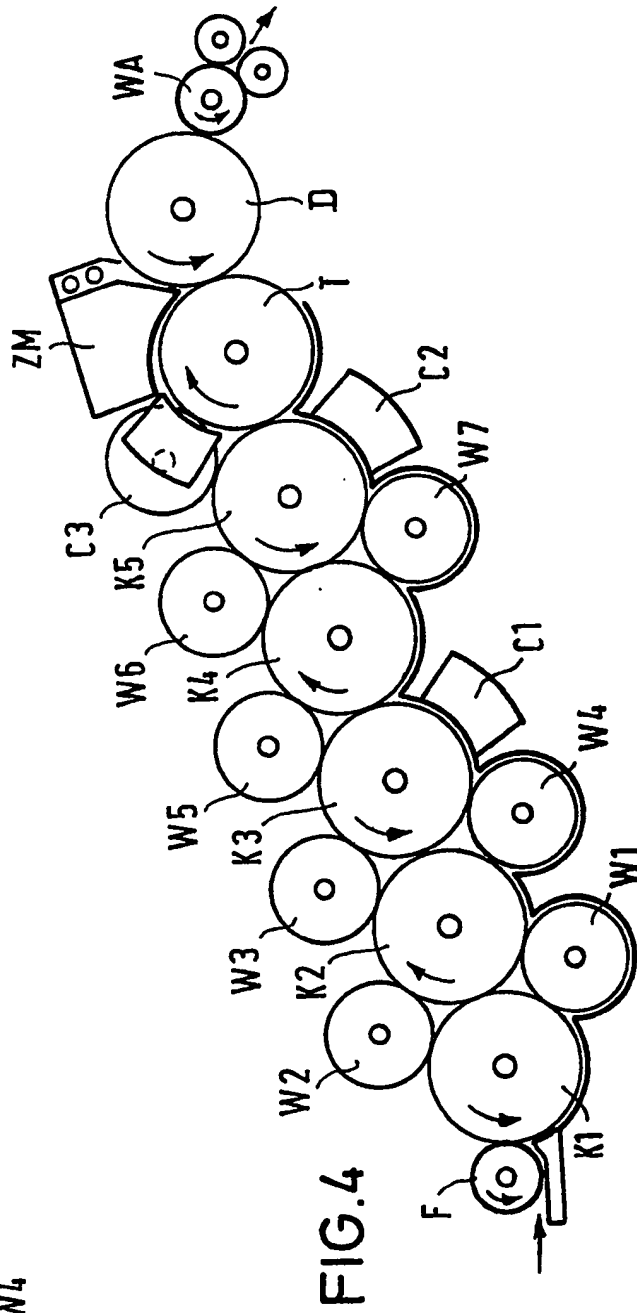
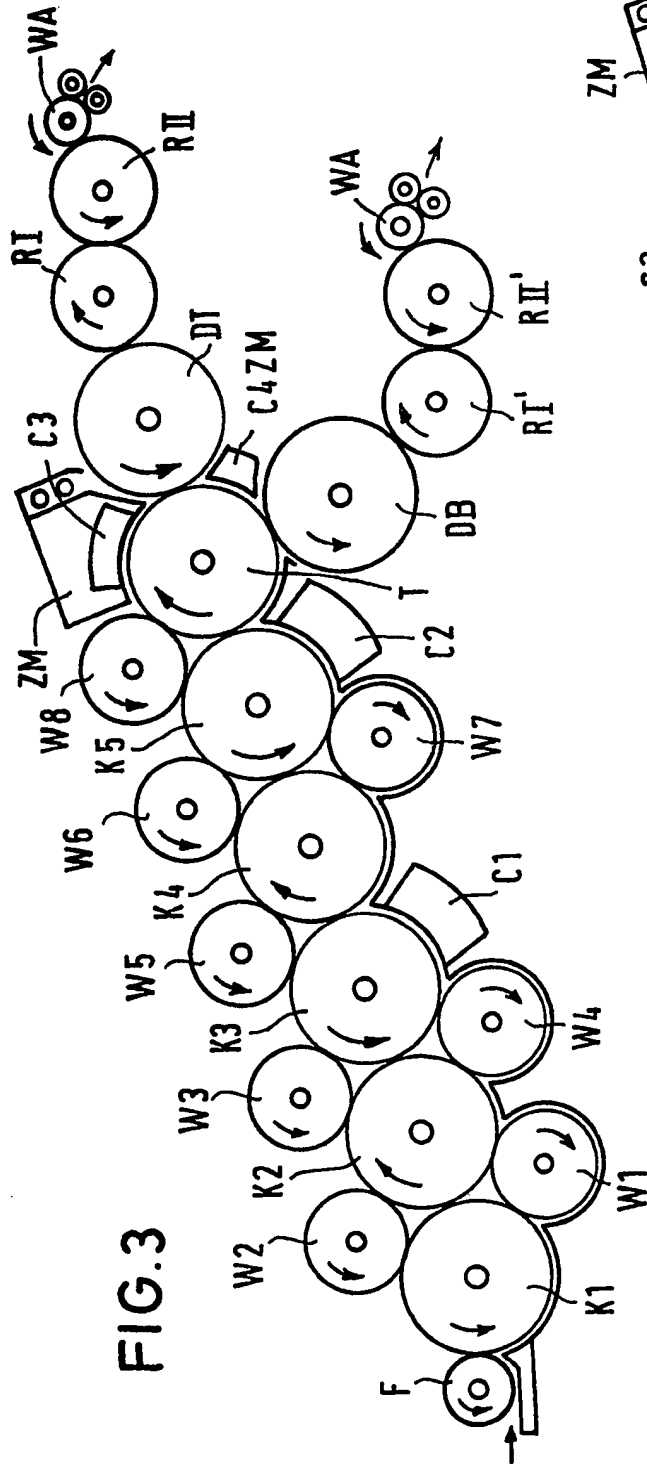


FIG. 5

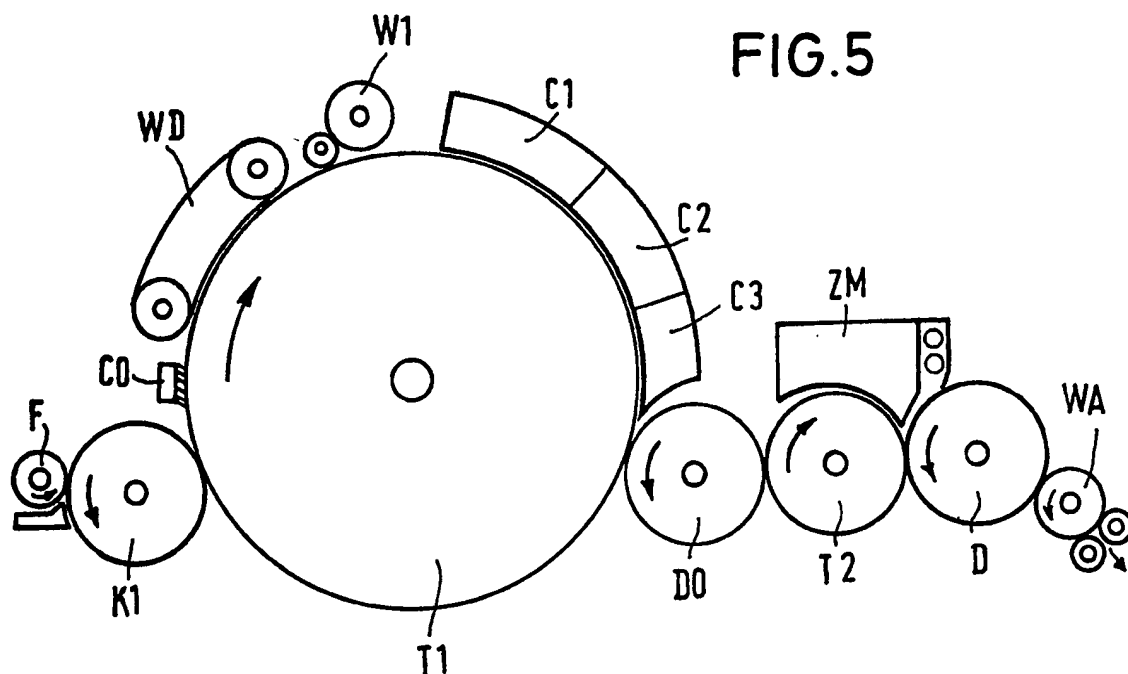
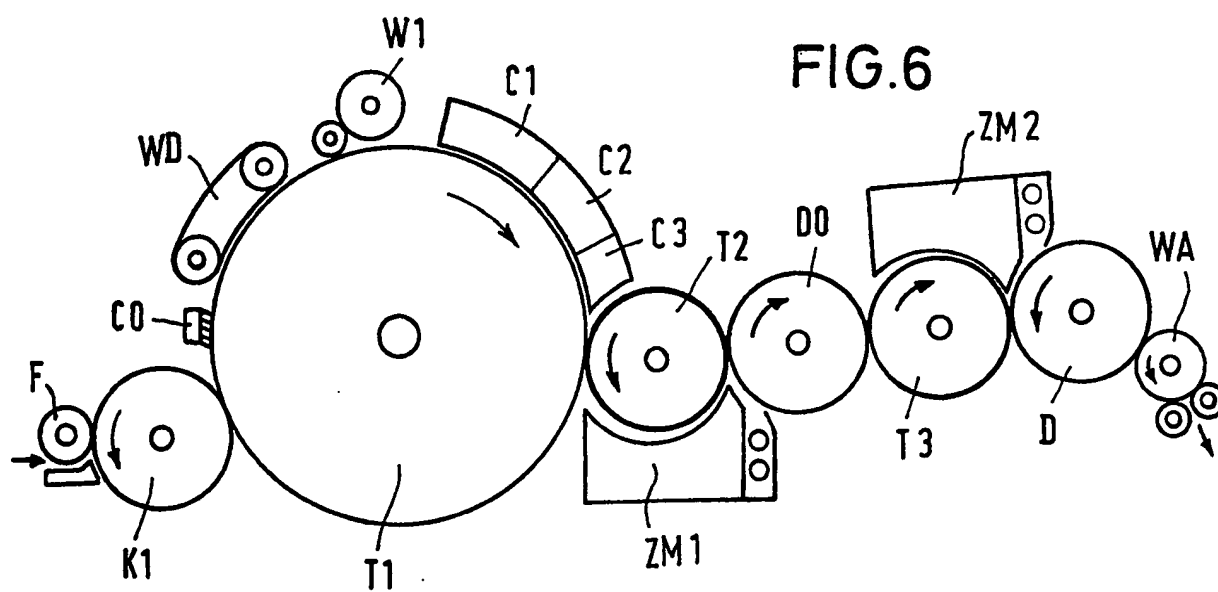


FIG. 6



## SPECIFICATION

**Method of and apparatus for producing a random fibrous web from spinning material**

The invention relates to a method of and an apparatus for producing a random fibrous web from spinning material, e.g. wool, cotton, man-made fibres and the like, by means of a carding process by disentangling fibrous flocks and spreading them out into a fibrous web and by continuous removal from the carding zone, after the carding zone the fibrous web being subject to an accumulator effect and subsequently to free web formation along a short section of predetermined length (centrifugal former), after which the web is removed by means of a doffer, or the like.

A method and an apparatus of the above type are known from DE—OS 28 30 367. In the so-called centrifugal former a further roller set with teeth is arranged between the cylinder and the doffing device, which roller is provided in a circumferential direction with a stationary material guide plate, the space between roller and guide plate tapering in the operating direction. In this connection, the guide plate ends before the connecting line between the central points of roller and doffing device at a predetermined distance to form a free web forming zone. The teeth of the interconnected roller are said to have a front setting of 0° or of only a few angular degrees. A device for the suction removal of air can be provided for the free web formation zone.

In the centrifugal-dynamic web forming means the carding section for separating out the fibres may comprise a conventional card or carder with carding flat or worker-clearer rolls at the cylinder or a combination of both carding systems. The carding section, however, may have several, e.g. five, small-diameter carding rolls arranged in tandem and associated with a corresponding number of worker rolls. The centrifugal-dynamic formation of fibrous web is suitable both for producing light-density nonwoven fabrics (8 to 25 g/m<sup>2</sup>) and likewise for nonwoven fabrics in the medium (up to 70 g/m<sup>2</sup>) and heavy (up to 250 g/m<sup>2</sup>) weight per unit range.

The object of the invention is to develop centrifugal-dynamic web formation in order to produce a fibrous web having isotropic fibre orientation and, in this connection, more particularly to improve the randomness of the fibres in the layer and to make it more stable. The invention is distinguished by the fact that before the zone of the centrifugal former the fibrous web is subject to a carding action at the cylinder. The fibrous web may undergo the action of a centrifugal former more than once and is subject at the cylinder to said carding action before the centrifugal former.

It has become apparent that such measures improve the formation of the fibrous web and allow the ratio of longitudinal strength to transverse strength in the nonwoven fabric to be controlled, increasing both longitudinal strength and transverse strength.

According to the invention the apparatus for producing a random fibrous web from spinning material is so constructed that a carding segment is

arranged before the centrifugal former at the cylinder having the centrifugal former. Advantageously, two centrifugal forming systems, comprising cylinder with centrifugal former, are provided in succession after the carding section at the adjacent doffer, the carding segment being provided at least at the last centrifugal former unit. A random layer of fibres is already produced at the first centrifugal former unit. The carding segment arranged at the next cylinder affects the random fibrous layer in the sense of partial evenness of the fibres, after which the fibrous web, thus treated, is subject to the further centrifugal former for the formation of a random fibrous web. Carding segment and web forming means produce double centrifugal web formation. In this connection, the carding section and the web forming means can be controlled independently of one another by the intermediate doffer. In this way it is possible to alter and select the longitudinal strength relative to the transverse strength in the nonwoven fabric in accordance with use in the nonwoven industry.

The carding segment connected before the centrifugal former is preferably a Cardmaster segment. However, a worker roll may also be used as carding segment.

It is also possible in the case of individual cylinders to arrange a Cardmaster segment in the preceding carding section.

The invention is described below with reference to the exemplary embodiments represented in the drawing.

Figures 1 to 4 show a diagrammatic representation of a random web carder in the form of a carding section comprising several carding rolls arranged in tandem and having one or more centrifugal web forming means using carding segments.

Figures 5 and 6 show further examples having a large cylinder.

In the embodiment of Figure 1 the carding section comprises five carding rolls, having a small diameter K1 to K5, which are arranged in tandem and which are associated with seven worker rolls W1 to W7. The spinning material is fed by means of the feed roll F with feed trough. The fibres are spun off from the carding section K1 to K5 to the intermediate doffer DO by the roll K5, namely by centrifugal force by means of the centrifugal force-web forming means ZM1. The random web on the intermediate doffer DO is taken up by the cylinder T either with the same density or at a higher speed and is compressed again at the final doffer D by centrifugal force by means of the centrifugal force-web forming means ZM2 into a web having isotropic fibre orientation. Double centrifugal web formation in tandem arrangement produces a particularly pronounced random carded fibre structure. The speed of the intermediate doffer DO is less than that of the carding roll K5. The speed of the cylinder T can be equal to or greater than the speed of the intermediate doffer DO. The speed of the cylinder T is greater than that of the final doffer D.

Due to the intermediate doffer DO in the arrangement according to the entire carding section

K1 to K5, carding section and web forming section T/D are largely independent of one another, which means that there is substantially more intensive and more optimum exploitation of the carding section for separation of the fibres and of the web forming section for formation of the fibrous web. At the same time, this simplifies control of the installation, as carding section and web forming section can be optimized independently of one another, which means that there is a simplification of the system which should not be underestimated.

There can be used as carding section any card or carder which, as carding elements, use either moving or stationary flats or workers and worker-clearer rolls, or the combination of flats and worker rolls. The fibre orientation provided by the carding section is of secondary importance for random web formation which takes place using centrifugal dynamics.

A carding segment C is arranged at the cylinder T. Advantageously, the former is constructed as a Cardmaster segment. A worker roll may also be used. A draw-off roll arrangement WA follows the doffer D. The intermediate arrangement of the Cardmaster segment evens out the random fibrous web.

The exemplary embodiment of Figure 2 likewise shows a carding section K1 to K5 with the worker rolls W1 to W8. In addition, two carding segments C1 and C2 are arranged at the random web carder at the rolls K3 and K5, the final worker roll W8 being arranged immediately before the centrifugal-dynamic web forming means ZM. The rolls speeds may correspond to those of the random fibrous web carder of Figure 1.

Figure 3 represents a further combination of carding rolls K, worker rolls W and carding segments C and centrifugal formers ZM1 and ZM2. The two former carding segments C1 and C2 co-operate with the carding rolls K4 and K5. The additional carding segments C3 and C4 are arranged inside the centrifugal former ZM1 and ZM2. Two doffers  $D_T$  and  $D_B$  are provided. Two rolls RI, RI' and RII, RII' and one draw-off roll arrangement WA respectively can follow the doffer roll in a conventional manner. A fourth carding segment C4 can be arranged as Cardmaster segment between the doffers  $D_T$  and  $D_B$ .

The random web carding installation of Figure 4 shows a further combination of carding rolls K1 to K5 with worker rolls W1 to W7 and a cylinder T at which there are arranged the centrifugal former ZM and a carding segment C3. Further carding segments C1 and C2 may be provided at the carding section at the carding rolls K3 and K5. The roll speeds may correspond substantially to those of the arrangement of Figure 1.

By Cardmaster segment is meant a carding portion in which rod fittings, joined together in parallel, extend in the direction of rotation of the cylinder.

The embodiments of Figures 5 and 6 show carding sections with one large-diameter cylinder respectively. The carding section has the carding roll K1 and the large cylinder T1 which co-operates

with the moving flat card WD, a worker-clearer device W1 and the carding segments C1, C2 and C3. The fibres are delivered by the cylinder T1 of the carding section to the intermediate doffer Do and compressed and are taken over at the same speed or at a greater speed by the cylinder T2 and are spun off to the doffer D by centrifugal force by means of the centrifugal-dynamic web forming means ZM and are compressed into a random web. The speed of the carding roll K1 is less than that of the cylinder T1. The speed of the cylinder T1 is greater than that of the intermediate doffer Do. The speed of the intermediate doffer Do may be equal to or less than the speed of the cylinder T2, the speed of the latter being greater than that of the doffer D. Due to the intermediate doffer Do the carding section with the cylinder T1 is independent of the centrifugal dynamic web forming means in terms of speed. The arrangement is also possible without the intermediate doffer Do in that the fibres from the cylinder T1 are taken over directly by the cylinder T2. In this connection, the speed of the cylinder T1 is equal to or less than that of T2.

In the embodiment of Figure 6 the carding section corresponds to that of Figure 5. The fibres are taken over from the carding section, comprising a combined roller and flat carder, by the cylinder T1 to the cylinder T2 and, compressed into a random web, are passed on from the latter by means of centrifugal force to the intermediate doffer D6. The random web on the intermediate doffer Do is taken over by the cylinder T3 at the same speed or at a greater speed and is compressed in a centrifugal-dynamic manner for the second time at the final doffer D into a random web having a particularly pronounced random structure. This is double centrifugal web formation for isotropic fibrous structure in the web and nonwoven fabric.

The examples of the random web carder shown provide an optimum isotropic fibrous layer at high web speeds.

## CLAIMS

1. A method of producing a random fibrous web from spinning material, such as wool, cotton or man-made fibres, comprising carding fibrous flocks so as to disentangle the latter and to spread them out into a fibrous web, continuously removing the web from the carding zone by means of a doffing device, and subjecting the fibrous web to an accumulator effect and subsequently to free web formation along a short section of predetermined length via a centrifugal former, in which the fibrous web is subjected to a carding action at a cylinder associated with the centrifugal former, at or up stream of a dynamic centrifugal web forming zone.

2. A method according to claim 1, in which the fibrous web is subjected more than once to the action of a centrifugal dynamic web forming means and to a carding action at said cylinder before and/or in the zone of a centrifugal dynamic web forming means.

3. Apparatus for producing a random fibrous web from spinning material, such as wool, cotton and man-made fibres, comprising a carding zone in

which fibrous flocks are disentangled and spread out into a fibrous web, a doffing device for removing the web continuously from the carding zone, a centrifugal former and cooperating cylinder spaced from the carding zone to form a free web-forming zone, and an additional carding element arranged immediately upstream of the centrifugal former and so as to cooperate with the cylinder.

4. Apparatus for producing a random fibrous web from spinning material, such as wool, cotton and man-made fibres, comprising a carding zone for carrying out a carding process in which fibrous flocks are disentangled and spread out into a fibrous web, a doffing device for effecting continuous removal of the web from the carding zone, a cylinder set with teeth provided in the direction of rotation with a stationary material guide plate, and a space defined between the cylinder and the guide plate which tapers in the operating direction, the guide plate terminating before a connecting line between the central points of the cylinder and the doffing device at a predetermined distance to form a free web forming zone (centrifugal-dynamic web forming means), in which a carding element is arranged immediately before the centrifugal former of the cylinder at the latter.

5. Apparatus according to claim 3 or 4, in which the carding element is a card master segment.

6. Apparatus according to claim 3 or 4, in which

30 the carding element is a worker roll.

7. Apparatus according to any one of claims 3 to 6, in which the carding element is arranged inside the centrifugal former.

8. Apparatus according to any one of claims 3 to 7, in which a plurality of centrifugal dynamic web forming means are arranged after the carding zone.

9. Apparatus according to any one of claims 3 to 8, in which the carding zone comprises a plurality of carding rolls having substantially the same diameter, and at least one carding segment is arranged in the carding zone to cooperate with one of the carding rolls.

10. Apparatus according to claim 9, in which the carding segment is a cardmaster segment.

11. Apparatus according to any one of claims 3 to 8, in which the carding zone comprises a large-diameter cylinder roll with worker and/or flat carding segment.

12. A method according to claim 1 and substantially as hereinbefore described with reference to, and as shown in any one of the embodiments illustrated in the accompanying drawings.

13. Apparatus according to claim 3 and substantially as hereinbefore described with reference to, and as shown in any one of the embodiments illustrated in the accompanying drawings.